

its greater principles. The laws enunciated by such men as Suess, Heim, Richthofen, Sorby, Brögger, Lehmann, Smith, Sedgwick and Darwin are given with genuine appreciation and generally illuminated by a brief but telling thumb-nail picture of their lives and achievements.

The translator, while suppressing too great detail in foreign work, has helped English readers by fitting into its place the occasionally omitted work of English-speaking geologists (see pp. 358, 360, &c.). This plan might with advantage have been extended; for instance, the work of Milne and Davison on earthquakes, of Allport, Bonney and Phillips on petrology, and of Ramsay and Topley in the connexion of geology and geography, might well have received fuller notice; and the application of geology to economic questions still demands its historian, who would have many a strange tale of failure and success to tell.

While the chapter on petrography gives the reader a good summary of the chief theories enunciated, the stages of their proof and their significance in the progress of the science, the palæontological section, probably from the magnitude of the subject, is not so instructive, and does not succeed in giving the reader a clear picture of the real meaning of the successive discoveries made.

Again, the stratigraphical chapter is at the same time one of the most difficult to treat fairly, and the one which is least balanced in its treatment. The introductory part, while giving considerable weight to discoveries in palæophytology, is admirable in picking out the chief contributions to palæontology as applied to stratigraphy, and in its pronouncement upon such subjects as the Sedgwick-Murchison controversy. But the detailed portion gives less than three pages to the Devonian system, omits all account of the zoning of the earlier Palæozoic rocks, and then proceeds to devote almost forty pages to the Trias.

The translator's work has been carefully and conscientiously done, and the book reads far better than is usually the case with translations. A few slips or misprints are unavoidable, and here and there an ambiguity of expression has crept in. We read *Jorulla* (66), physician (77), Linnaeus (for *linnaea*, 104), on the age of the human race (the antiquity of man, 195), Davis (David, 253), Eugean Isles (259), microscopic (macroscopic, 369), and aquo-igneous, for which we would venture to suggest the less cacophonous hydrothermal.

The publisher is evidently under the impression that the severer form of the German original requires tempering to that shorn lamb the British reader. The translation has been alleviated by portraits of eminent geologists, many of them admirable and some new. Those of Suess and of Zittel are excellent, but we can hardly bring ourselves to believe that that of Hutton is lifelike. Then, in addition to the shortening of some of the drier details, we have the wholesale omission of the bibliographies which accompany each chapter and many sections of the original. We hope and believe that this is a mistake. It is the serious student who will consult this work; to him the bibliographies are essential, and this will drive him to the original. In some future edition we hope to see these restored, and when this is done we would suggest that even the

specialist is deserving of, and will certainly be grateful for, anything which helps to pilot him quickly and safely to the haven of his inquiries. Such aid as author and printer can give are his right. The solid mass of print should be broken up by the use of more sections and headings, italics and black-faced type, and above all good headlines to the pages (as in the original), so that a man in search of particular information may find it with the least possible expenditure of time and temper.

But all geologists are grateful to Prof. Zittel for his thorough and painstaking labour, for his fairness and breadth of view, and for his wonderful grasp of the whole of his science; and English-speaking geologists are under an especial debt of gratitude to Mrs. Ogilvie-Gordon for her timely, accurate, and well-written translation.

PLANE SURVEYING.

Plane Surveying. A Text and Reference Book for the Use of Students in Engineering and for Engineers Generally. By Paul C. Nugent, A.M., C.E., Associate Professor of Civil Engineering, Syracuse University. Pp. xvi+577. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1902.) Price 14s. 6d.

THIS book treats of that elementary part of the subject of surveying, especially useful to engineers, which deals generally with surveys of small areas on large scales. Any book on the subject which comes from America is worthy of attention, since American practice differs in many respects from ours, and this text-book is useful for the purpose of comparative study.

Amongst the subjects dealt with are linear measuring instruments and the measurement of lines, chain surveying, compass surveying, levelling, transit surveying (*i.e.* the use of the theodolite), topographical, hydrographic and mine surveying, and U.S. Government large-scale surveys and resurveys. There are also chapters on the theory of telescope construction, the planimeter, the slide rule and the solar instrument (sun compass), and an appendix on photo-topographic methods.

We have a good deal to learn from America in the use of steel tapes, which for many surveying purposes should supersede the chain, and some useful information on the question will be found at the beginning of the book. The method here described of cutting up the ground in a chain (or tape) survey differs from the English system, and the latter is preferable. A great deal of space is given to surveying with the compass; indeed too much space considering the essential inaccuracy of all compass methods; and on the other hand but little is said about triangulation with a theodolite or traversing with the same instrument, subjects which each deserve a chapter to themselves.

In the chapter on topographical surveying we have topographical methods described from the engineering surveyor's point of view, and for certain large-scale engineering topographical surveys the methods mentioned are useful. But they are not generally the methods used by surveyors on regular topographical surveys, such as the topographical branches of the Survey of India or the U.S. Geological Survey, and the description given of the

use of the plane-table as a topographical instrument is inadequate.

About a dozen pages are devoted to hydrographic surveying, and it is no doubt desirable that the engineer should have a bowing acquaintance with the subject, mainly to enable him to carry out the survey of small inland waters. If he had a larger task on hand, he should consult one of the recognised treatises on the subject.

In a book on surveying written by a professor of engineering it is remarkable that there is so little mention of the execution of special surveys for engineering purposes, such as railway and canal surveys. The whole theory of plane surveying is so simple that the engineer is far more likely to look up a text-book to discover what is the practical method adopted than to discover the solution of some theoretical problem, and the ideal text-book should largely quote examples of practical methods and expedients. The chapter on mine surveying contributed by Mr. W. S. Hall is, however, an example of the brief discussion of the survey methods used for a special engineering purpose, and appears to be useful and clear.

There is a long appendix of some fifty pages on phototopographic methods and instruments, being a paper by Mr. J. A. Flemer in the Report of the U.S. Coast and Geodetic Survey for 1897. Such a system has been much advocated in various quarters during the last few years, and it is interesting and ingenious. Under certain special conditions, such as those in the Canadian North-West, where the features are bold and open and where the field season is short, and where sometimes only occasional glimpses through the clouds can be had of the higher peaks, the method is efficient and economical. But under ordinary conditions it is neither, and as a method it cannot be said to be established, nor is it likely to be; and the inclusion of a detailed report on a tentative topographic method in a book devoted to large-scale engineering survey increases the size of the book, but not its value.

As regards the nomenclature of the book, we do not like the author's division of surveying into plane surveying and geodesy, although authorities can be found in favour of it. The term geodesy should be reserved for those scientific operations of which the object is the determination of the form and size of the earth. Some of the words used are new, *e.g.* "declinator," meaning the box containing the compass. The northings and southings of a traverse are here called "latitudes," and the eastings and westings "longitudes." We are glad to see that the author uses the word "plotting" and not "platting." The latter is sometimes found in American technical works and is objectionable in spite of its greater antiquity.

C. F. CLOSE.

INSPECTION OF RAILWAY MATERIALS.

The Inspection of Railway Materials. By G. R. Bodmer, A.M.Inst.C.E. Pp. ix + 154. (London: Whittaker and Co., 1902.) Price 5s.

THE inspection of their products has long been a source of worry to the manufacturers of railway material, be it locomotives, bridges or rails. Consulting engineers have their own ideas as to what the tests

should be; few specify alike, with the result that manufacturers have to make various qualities of material for the same purpose—a state of affairs not conducive to economy of manufacture.

The question of material is not the only trouble. Consulting engineers very often specify methods of manufacture for their material. Interference of this kind in works management is most expensive to the manufacturer; it upsets the sequence of the work, delays progress, and in the end has to be paid for by the railway shareholders.

A third complaint might be made by manufacturers, and one which very largely adds to the cost of work in many cases, and that is, what kind of man is the inspector? It is on this point the author of this book commences. He says:—

"The inspection of railway material is a class of work for which every inexperienced neophyte devoted to the engineering profession imagines himself to be qualified."

The author goes on to say that

"in reality, however, many qualifications are required to make a good inspector, and chief among these is experience, the one most likely to be wanting in a young engineer."

With this we thoroughly agree. In certain specifications the general clauses are such that the contractor is entirely in the inspector's hands, and if the inspector does not know his work the result is disastrous. Much has been written lately on the standardisation of locomotives, for instance, as a means of shortening the time of delivery; but given standard tests, non-interference in works practice and a practical man as resident inspector, there is no necessity to crystallise any design, for when all is said and done a thing of yesterday is old.

This book has evidently been written by one who has been through the "inspection mill." There is much evidence of this in the various chapters. Chapter ii. deals with rails, ordinary and tramway, fish plates, &c. We are told that in the case of fairly heavy rails it is possible to inspect four or five at a time. The reviewer could never do more than three continuously.

Steel sleepers are dealt with in chapter iii. The information is well up to date, although we cannot agree that the Indian sleeper fitted with punched up lugs cannot be gauged for gauge unless fitted with a length of rail, &c. The author might have explained that with this type of sleeper the position of the keys for normal gauge is outside the rail, for a medium curve one is moved inside, and for a very sharp curve both are placed inside.

On tyres and axles we find much useful information, and further on rolled material generally is very fully gone into, the tests being carefully explained. Chapter vii. deals very thoroughly with the condition governing the specifications for steel rails, more particularly discussing the mechanical tests, which vary very largely in present-day practice. The work concludes with a short account of the inspection of finished work dealing with various parts of rolling stock, and fulfils the intention of the author in being a brief guide to the inspection of railway material for the use of engineers.

N. J. L.